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The Application of Decision Analytic Techniques to the Test and Evaluation Phase of the Acquisition of a Major Air System

Michael F. O'Connor
Dennis M. Buede

DECISIONS and DESIGNS, INC.

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THE APPLICATION OF DECISION ANALYTIC TECHNIQUES TO THE TEST AND EVALUATION PHASE OF THE ACQUISITION OF A MAJOR AIR SYSTEM

by

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This effort explored

The purpose of this effort has been to explore the feasibility of applying decision analytic techniques to the test and evaluation phase of the acquisition of a major weapons system. As a specific example, the technology ~~has been~~ was applied to the human engineering tests of the F18 fighter aircraft which is currently in the test and evaluation phase.

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The current

Currently, the procedure for evaluating the suitability of ~~the~~ an air system from a human engineering standpoint ~~consists of test pilot~~ is inadequate inspections of the air system. When deficiencies are noted, a report is written, and the defect is classified as a Category I, II, or III defect. A Category I defect should ground the system; and Categories II and III represent successively less severe defects which are sometimes not corrected. The defects are reported on "yellow sheets" which are often acted upon too late for appropriate correction of the problems. A method is needed to communicate the information to appropriate decision makers in a more timely manner and also to prioritize the desired corrections so as to facilitate cost/beneficial decision making.

The proposed response ~~to this need~~ is a computerized system, implemented on an IBM 5100, which contains the test and evaluation information appropriately prioritized. To achieve this goal, two main tasks must be accomplished. One is the development of a hierarchical evaluation ~~structure~~ procedure was constructed which relates all the test and evaluation information to missions of the F18. Because there are so many controls, systems, displays, etc., and since the inter-relations between these in terms of pilot operations for mission accomplishment are extremely complex, a modeling effort which attempts to categorize instruments into functional areas would be unsuccessful. It has, therefore, been decided to break out the structure using the roles of the pilot were pilot, e.g., controller of aircraft (COA), systems manager (all systems), tactician, etc. The roles are decomposed into duties within the framework of mission phases, e.g., controlling the aircraft under visual flight requirement (VFR) conditions during the tactical mission phase when faced by a surface-to-air missile. These duties are further decomposed into tasks. The test pilot then rates the aircraft with respect to the ability to accomplish the specific task, and this is done for all tasks, duties, and roles.

An initial structure has been developed for the controller of aircraft role for the fighter version of the F18, and this structure has been implemented on the IBM 5100 portable computer. In order to use such a structure, it is necessary to develop a meaningful rating scale on which to rate the aircraft with respect to these tasks. Two major considerations are involved--pilot workload and system effectiveness. Increased pilot workload can detract from system effectiveness, and increased system effectiveness can require increased workload. Prior research on this topic has been examined, and a working version of a rating scale has been developed.

Proposed future work will involve improvement of the rating scale, expansion of the COA structure to the entire F18, i.e., all roles, duties, and tasks, and development of a handbook for use of the scale and for use of the computerized inventory.

Summary

This report describes the work done by Decisions and Designs, Incorporated for the Naval Air Test Center, Code 5Y702, Patuxent River, Maryland, the funds for which were added to Contract N00014-75-C-0426 administered by the Office of Naval Research.

The purpose of the effort has been to explore the feasibility of applying decision analytic techniques to the test and evaluation phase of the acquisition of a major weapons system. Specifically, the purpose has been to apply the technology to the human engineering tests of the F18 fighter aircraft which is currently in the test and evaluation phase.

Currently, the procedure for evaluating the suitability of the air system from a human engineering standpoint consists of test pilot inspections of the air system. When deficiencies are noted, a report is written, and the defect is classified as a Category I, II, or III defect. Category I is a defect which should ground the system; and Categories II and III represent successively less severe defects which are often not corrected. The defects are reported on "yellow sheets" which are often acted upon too late for appropriate correction of the problems. A method is needed to communicate the information to appropriate decision makers in a more timely manner and also to prioritize the desired corrections so as to facilitate cost/beneficial decision making.

The desired response to this need is a computerized system, implemented on an IBM 5100, which contains the test and evaluation information appropriately prioritized. To achieve this goal, two main tasks must be accomplished. One is the development of a hierarchical evaluation structure

which relates all the test and evaluation information to the missions of the F18. Because there are so many controls, systems, displays, etc., and since the inter-relations between these in terms of pilot operations for mission accomplishment are extremely complex, a modeling effort which attempts to categorize instruments into functional areas would be unsuccessful. It has, therefore, been decided to break out the structure using the roles of pilot, e.g., controller of aircraft (COA), systems manager (all systems), tactician, etc. The roles are decomposed into duties within the framework of mission phases, e.g., controlling the aircraft under visual flight requirement (VFR) conditions during the tactical mission phase when faced by a surface-to-air missile. These duties are further decomposed into tasks. The test pilot then rates the aircraft with respect to the ability to accomplish the specific task, and this is done for all tasks, duties, and roles.

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Proposed future work will involve improvement of the rating scale, expansion of the COA structure to the entire F18, i.e., all roles, duties, and tasks, and development of a handbook for use of the scale and for use of the computerized inventory.

CONTENTS

FIGURES

THE APPLICATION OF DECISION ANALYTIC TECHNIQUES TO THE TEST AND EVALUATION PHASE OF THE ACQUISITION OF A MAJOR AIR SYSTEM

1.0 INTRODUCTION

The purpose of this study has been to explore the feasibility of the application of decision analytic techniques to the test and evaluation phase of a major air system, in this case, the fighter version of the F18 currently in the prototype development stage. Because the F18 is a single-pilot air system, the pilot will have more roles than that of a two-man fighter such as the F4 or F14. Such broad roles include controller of aircraft, tactician, and manager/ operator of numerous systems, e.g., communications systems, sensor systems, weapons systems, and navigation systems. It is anticipated that accomplishing all the roles that may be required of the pilot during particular mission phases may prove to be very difficult.

During the testing of the F18, it is therefore imperative that the human engineering aspects of the system be scrutinized with extreme care. Current procedures for accomplishing such evaluations involve having test pilots report deficiencies as Category I, II, or III level deficiencies (where Category I is most serious) using forms known as "yellow sheets." One problem with this reporting procedure involves the administrative burden of translating the yellow sheets into action which corrects the serious deficiencies. Often, such corrections occur too late, if at all.

A procedure is necessary for more rapid communication of deficiencies to decision makers in positions to implement corrective action. In response to this need, work is underway at the Human Engineering Branch of the Naval Air Test Center (NATC), Patuxent River, Maryland, and at the Human Factors Engineering Branch of the Pacific Missile Test Center (PMTC), Point Mugu, California, to develop a more efficient evaluation system. This effort has resulted in the development of pilot

task inventories for the S3A and P3C air systems (see NATC reports SY-127R-76 and SY-122R-75). Such inventories are hierarchical in nature starting at the general level of pilot roles, e.g., controller of aircraft (COA), navigator, tactician, sensor operator, etc. Each role is subdivided into tasks, e.g., control aircraft (A/C) in day visual flight (VFR) conditions during the launch of the A/C. The duties are further divided into tasks, e.g., for COA during launch, control A/C during taxi onto catapult, control A/C during rotation after catapult launch, etc. Test pilots can then rate the A/C with respect to each of the duties. Such reports can indicate not only where the A/C is deficient, but also where the A/C is superior.

Decisions and Designs, Incorporated (DDI) has worked with Lt. Wade Helm who has been conducting the work on the development of pilot task inventories. In addressing the question of the feasibility of improving the inventory approach using decision analytic techniques, two major tasks have been addressed.

1.1 Task 1

Task 1 has involved the development of a hierarchical pilot task structure for the fighter version of the F18 A/C. This task has utilized multi-attribute utility analysis (MAUA) techniques. These techniques provide a mechanism not only for rating the A/C with respect to different pilot tasks, but also for aggregating the ratings across tasks, mission phases, duties, and even roles. An aggregate measure of the quality of the system at any particular level desired can be obtained from the hierarchical value structure that results from such a MAUA analysis.

A pilot structure has been developed for the COA role of the F18 pilot, limited to VFR conditions (excluding IFR/night conditions). This structure has been implemented on an IBM 5100 portable computer. Such implementation allows pilots to complete their ratings immediately upon test completion and provides relevant decision-makers with test results in little more than one day. Such a mechanism therefore not only provides a mechanism for aggregate high-level quality ratings as well as specific task ratings, but it also provides for the rapid communication of those ratings to appropriate decision-makers.

1.2 Task 2

Task 2 is necessary for successful implementation of the pilot task inventory hierarchy. In addition to the necessity for a sensible, meaningful decomposition of pilot roles, duties, and tasks, a means of validly rating the A/C with respect to these tasks must be developed. Such a rating scale must have numerous qualities.

a. It must promote intra-rater consistency. Raters should not vary in the manner in which they use the mechanism.

b. It must promote inter-rater agreement. Different raters should agree on the meaning of the rating scale categories and also on which ratings to assign to which defects and/or advantages.

c. The scale must be valid. Put simply, the rating scale, when used as designed, should produce ratings such that A/C receiving higher ratings are actually "better" then those receiving lower ratings.

Qualities that produce such properties in scales are numerous. The scale categories must be clear, meaningful, and directly relatable to observed A/C properties. For example, the use of a simple five-point rating scale, bad to good, will likely cause problems with respect to all three of the above criteria. Numerical ratings are, in fact, desirable for purposes of aggregation across tasks, but the numbers must be meaningful and well anchored by simple verbal explanations.

The tasks a pilot must accomplish are actually multidimensional; they involve many sub-tasks. Each sub-task can involve numerous sense modalities--visual, auditory, touch; cognitive skills--perceptual, memory, computation, etc.--and physical endeavors. The difficulties in accomplishing tasks can therefore vary due to the nature of the A/C and the skills required. One task may require physical efforts beyond that of most pilots; another may involve a tremendous cognitive workload, one that exceeds the capabilities of skilled test pilots, let alone those of less experienced pilots. (An extended discussion of the evaluation procedure for A/C can be found in reference #4.)

The differing tasks would, therefore, seem to require different scales, but using different scales can greatly increase the difficulty of using a procedure such as the one discussed. Recall that currently the test pilot need only note those citable deficiencies for report. The task inventory requires ratings of the A/C with respect to all tasks. This could potentially be a great burden to an already very busy test pilot, thus encouraging rapid and possibly superficial consideration of ratings. Introducing different scales for different tasks would, therefore, seem to be ill-advised. A simple scale must be developed for all tasks.

Cooper and Harper (Reference #1) have researched the problem of developing a scale for rating aircraft handling qualities, and the result of several improvements has been a ten-point non-linear scale with well defined meanings for the ratings. The pilot must answer specific questions such as "Is the A/C controllable?" A no answer implies a 10 (worst) rating. Conditional on a yes, the next question is whether or not adequate performance is attainable with a tolerable pilot workload. A no answer leads to a rating of 7, 8, or 9, depending on the severity of the deficiency. A yes answer leads to another question.

As noted by Cooper and Harper, the question of A/C performance and associated technical quality of the A/C is directly related to pilot workload. A pilot can <u>compensate</u> for inadequate A/C performance by increasing his <u>workload</u>. Cooper and Harper discuss compensation, stating "Stated in another way, it (compensation) is the measure of additional pilot effort and attention required to maintain a given level of performance in the face of less favorable or deficient characteristics." (Reference #1, p. 13.) The points on the Cooper-Harper scale are thus for the most part definitions of performance conditional on the degree of pilot compensation required.

Even though there exists a clear dependency between the technical effectiveness of an A/C and the pilot workload, it is desirable to have somewhat independent ratings of them. A decision maker would like to know, "All things considered, how technically effective is the F18?" A second question involves the degree of pilot workload necessary to achieve that effectiveness. Part of the research done on this project was to investigate the feasibility of developing separate scales for workload and performance.

The Naval Air Test Center has adopted a modified version of the Cooper-Harper scale, and pilots are accustomed to using such an approach, especially given the clarity of the questions asked. The hierarchical structure and MAUA procedures discussed earlier require an interval scale for purposes of aggregation of ratings. The research effort also has addressed the question of using a Cooper-Harper-like scale but arriving at an interval scale rather than the obviously ordinal Cooper-Harper scale. The results are discussed in the next section.

2.0 CURRENT STATUS OF THE INVENTORY EFFORT

2.1 Pilot Task Inventory Development

The development of the pilot task inventory emphasized the mechanism for aggregation across tasks. The earlier inventories did not provide summary ratings at higher levels of the structure. Because there are numerous ways in which the tasks can be broken out, a major part of the effort involved finding the most meaningful task breakdown. For example, one role of the pilot is the controller of aircraft role (COA). This role must be performed in several mission phases and also must be performed by both the lead and the wingman. Should the hierarchy therefore involve the ordering

Pilot
Mission Phase
COA
Lead-Wing

or should the ordering be that below?

Pilot
Lead-Wing
COA
Mission Phase

The first ordering was chosen for the initial structure, but in future work other structural orderings will be considered. The reason for choosing the first ordering was that whether or not a task is performed is dependent on mission phase. For each mission phase, the pilot has different roles, and not all roles appear under each mission phase. Similarly, the importance of different roles, duties, and

tasks is dependent on mission phase. Also, the lead-wing distinction is only relevant for certain mission phases. It should be noted that summary measures can be provided at any level of the hierarchy, and by using appropriate weighting schemes, factors that appear at lower levels can be elevated to a higher level. For example, later in this section, two versions of the inventory will be presented, one for the F18 pilot as lead and one for the pilot as wingman.

The current hierarchical structure of the F18 inventory is displayed in Figure 1. As illustrated, the structure contains six levels. The top level is the summary level for the entire A/C, the pilot level. The next three levels contain flight requirements, mission phases, and mission sub-phases which are well documented in a scenario prepared to accompany the test flight evaluation. The next level, the duty level, describes the roles the pilot must play, i.e., COA, tactician, and manager of all the A/C systems. The lowest level contains specific tasks that must be accomplished dependent on mission sub-phase and duty.

A section of the inventory has been developed and implemented on an IBM 5100 portable computer. That section is for the COA role under visual flight requirement (VFR) conditions only. The actual computer output is displayed in Section 2.3.

The necessary judgments for this initial model were obtained from a test pilot familiar with the F18. Since the F18 has not been flown, the ratings are necessarily based on incomplete information. Furthermore, the ratings were made during an abbreviated session in which the pilot could not give the task as much time as is desirable. Finally, the ratings were made on a scale currently under development (to be described in Section 2.2). All this indicates that the

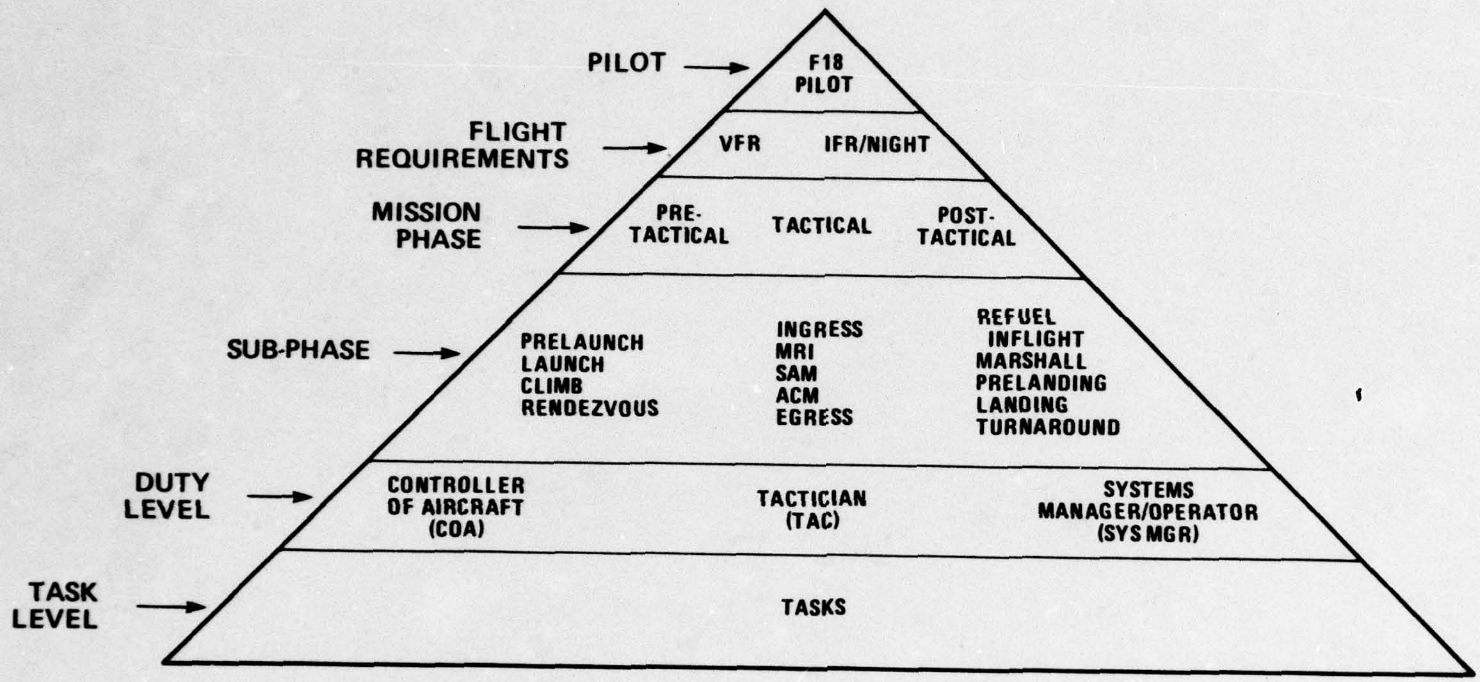


Figure 1

THE F18 PILOT TASK INVENTORY HIERARCHY

input judgments should be viewed as tentative estimates of what the actual ratings might turn out to be.

The tasks that describe this portion of the inventory are broken out according to mission sub-phase in the following list.

Controller of Aircraft (COA) Tasks

<u>Pre-Tactical Phase</u>

Pre-Launch
- No COA tasks

Launch
- Control aircraft during taxi on the catapult
- Control aircraft during military and maximum power run-up prior to launch
- Control aircraft during rotation after catapult launch
- Control aircraft during clean-up (retract gear, flaps)
- Control aircraft in VFR launch pattern (500 feet at 7 miles)

Climb
- Control aircraft during climb-out
- Control aircraft during basic transition from one flight altitude to another (climb, level-off, decent turns)

Rendezvous Enroute
- Control aircraft during the visual acquisition phase (check radar, TACAN, etc.)
- Control aircraft during CV rendezvous
- Maintain parade position
- Perform parade cross-unders
- Maintain cruise and column positions
- Perform lead change
- Control aircraft during system checkout and completing combat check list

<u>Tactical Phase</u>

Ingress
- Accelerate to tactical speed
- Conduct tactical maneuver during outside visual scan and while operating sensor systems

Medium Range Intercept (Aim 7)
As lead, maneuver toward threat force and acquire target
As wingman, maneuver into tactical position and acquire target
As lead, maneuver tactically while using weapon displays (radar, HUD)
As wingman, maneuver while maintaining tactical position and monitoring sensors
As lead, maneuver aircraft while launching weapon
As wingman, maneuver A/C and launch weapon
Control aircraft while visually reacquiring strike force

SAM Threat (SA-2)
As lead, maintain tactical maneuver while monitoring threat system displays
As lead, perform evasive maneuvers while visually acquiring threat and activating ECM
As wingman, maintain tactical maneuver while monitoring threat system displays
As wingman, perform evasive maneuvers while visually acquiring threat and activating ECM

ACM (AIM-9, GUN)
As lead, control aircraft while maneuvering towards threat force
As wingman, maintain tactical position and visually acquire target
Maneuver while employing weapons system
Control aircraft while visually reacquiring strike force

Egress
Conduct tactical maneuver during outside visual scan and while operating sensor system

<u>Post Tactical Phase</u>

Inflight Refueling
Control aircraft during visual acquisition phase
Control aircraft during rendezvous
Control aircraft while tanking

Marshall
Control aircraft during marshall, i.e., maneuver so as to make marshall time
Control aircraft while completing penetration checklist

Pre-Landing
Control aircraft during penetration
Control aircraft during transition to landing configurations and completing checklist

Landing
- Control aircraft during CCA
- Control aircraft during landing approach
- Control aircraft on glide slope during approach
- Control line-up of aircraft during approach
- Control aircraft while maintaining airspeed
- Control aircraft after wave-off
- Control aircraft during taxi out of arresting gear
- Control aircraft while lifting flaps and folding wings
- Control aircraft during taxi forward while doing post-landing checklist and systems checkout

Turnaround
- No COA tasks

The pilot was asked for two kinds of judgments. First, at the lowest level of the hierarchy, he was asked to rate the F18 with respect to each specific task on a nine-point scale. He was next asked to provide relative importance weights at each level of the hierarchy. Such weights indicate the relative importances of each factor or sub-factor dependent on hierarchy level. For example, at the lowest hierarchy level, there are five tasks for the COA during launch. The pilot was asked to assign the most important COA task for the launch sub-phase a value of 100 and to rate the other four tasks in that subphase by comparison with the most important. The actual session involved in-depth discussion of the meaning of these ratings as well as the aggregation procedure.

2.2 Rating Scale Development

As indicated in the extensive discussion in Section 2.1, the rating scale to be used to evaluate the F18 must satisfy numerous criteria. The development of the scale is therefore a difficult and critical task to which a great deal of attention has been given in this feasibility study. Because it is desirable, if possible, to have two ratings of the system, one with respect to pilot workload, and one with respect to the technical effectiveness of the system, efforts

were made to develop separate scales for each, but no satisfactory breakout was achieved. Ratings could be made of workload dependent on effectiveness, but such ratings become difficult to aggregate in the inventory. The problem obviously merits further research.

One early version of the scale closely parallels that developed by Cooper and Harper. The scale illustrated in Figure 2 varies from zero (minimum quality) to 100 (maximum quality). An attempt was made to establish scale values that would form a valid interval scale. The numbers in Figure 2 are early, quick estimates and do not reflect the interval scale desired. Note that this scale also contains reference to the three categories used for "yellow sheet" citation.

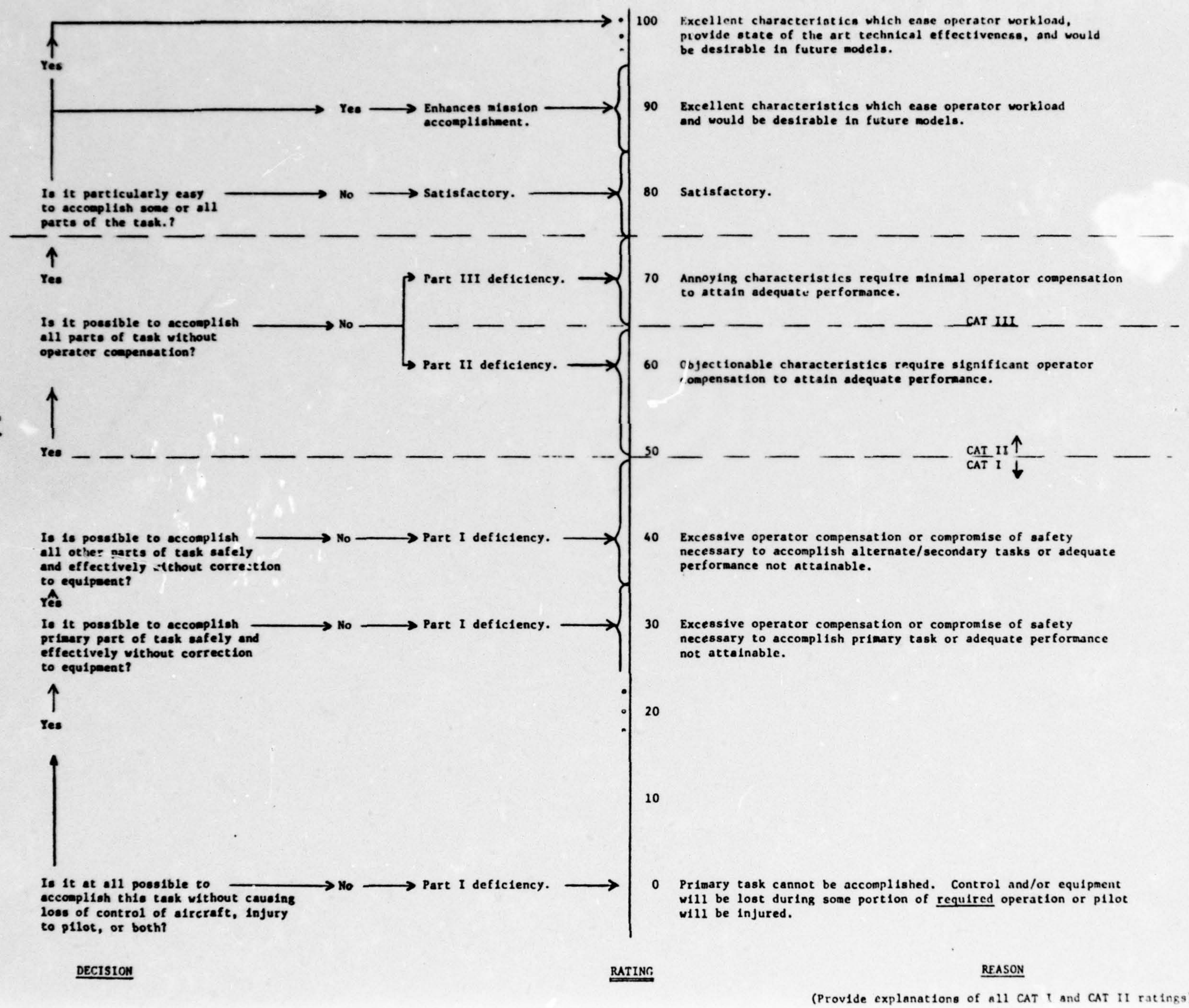
The form of the scale used for the pilot evaluation is illustrated in Figure 3. This scale was developed with the test pilot who provided the ratings of the F18. It was the pilot's feeling that the categories are meaningful and he had little difficulty making ratings using the scale. The ratings were given on a scale from zero to eight. The numbers that appear in the model in Section 2.3 resulted from multiplying ratings by ten. This was done because of the current software requirements.

Some explanation of the scale is in order. The average rating is 5.0, satisfactory. This rating implies that the task requires tolerable compensation, not unreasonable, given total pilot workload.

Rating 4 implies that the pilot can learn to accomplish the task to specifications but he must train to do so.

Rating 3 implies that even with training the pilot can barely accomplish the task to specifications.

FIGURE 2. POTENTIAL RATING SCALE FOR INVENTORY OF F18 PILOT TASKS



Rating		Explanation
8	Outstanding:	The design enhances mission phase accomplishment. Multiple tasks are integrated.
7	Excellent:	The design enhances specific task accomplishment.
6	Good:	No pilot compensation is required in accomplishing the task.
5	Satisfactory:	Accomplishing the task involves tolerable pilot compensation.
4	Substantial compensation required.	The pilot must train to overcome the difficulty resulting from the deficiency.
3	Heavy compensation required.	The task can just barely be accomplished to specifications.
2	Excessive compensation required.	The task cannot be accomplished to specifications. (The task can be accomplished, but not anywhere near to the specifications.)
1	The task cannot be accomplished at all.	
0	Attempting task leads to very dangerous situation.	The aircraft may crash.

FIGURE 3. RATING SCALE USED FOR F18 TASK INVENTORY

Rating 2 implies that the pilot can barely accomplish the task, let alone the specifications.

Rating 1 implies the task cannot be accomplished at all and for the COA role, the pilot may be fighting to keep the aircraft under control.

Rating 0 means that even attempting the task is extremely dangerous and may cause a crash.

Rating 6 implies that the aircraft is above average with respect to this task requiring no pilot compensation to accomplish the task.

Rating 7 implies that the task can be accomplished instantaneously with the flip of a switch.

Rating 8 implies that the flip of a switch accomplishes not only one task instantaneously but several tasks involved in a mission phase.

As indicated, this problem is by no means solved. If the scale in Figure 3 or some other related version is finally chosen, a means of transforming the categories into an interval scale must also be established and implemented.

Because the scale is obviously not an interval scale, the output of the model must be considered as purely tentative at this stage. Nonetheless, the general procedure for implementing the hierarchy should be clear from the example.

2.3 Pilot Task Inventory Computer Output

The following computer output contains summaries for the COA section of the F18 pilot task inventory. A number from 1 to 6 digits long describes each factor of the hierarchy. The numbering system is as follows.

First Digit - Pilot (total system)
1. Total System

Second Digit - Flight Requirement Conditions
1.1...VFR   1.2...IFR

Third Digit - Mission Phase
1.1.1...VFR Pre-Tactical (PRETAC)
1.1.2...VFR Tactical
1.1.3...VFR Post-Tactical (POST-TAC)

Fourth Digit - Mission Sub-Phase
E.G. 1.1.1.1 VFR, Pre-Tactical, Pre-Launch
1.1.1.2 VFR, Pre-Tactical, Launch

Fifth Digit - Duty
E.G. 1.1.1.1.1 VFR, PRETAC, Pre-Launch, COA
1.1.1.1.2 VFR, PRETAC, Pre-Launch, System Manager/Operator (SYS/MGR)
1.1.1.1.3 VFR, PRETAC, Pre-Launch, TACTICIAN (TACTN)

Sixth Digit - Task
E.G. 1.1.1.1.2.1 VFR, PRETAC, Launch, COA, Taxi onto catapult (TAXI/CAT)

The computer model requires that each model factor be abbreviated by a label no more than ten characters in

length. The reader can either guess at the meaning of these labels or can consult the list of tasks in Section 2.1.

The following is Section 1.1.1.2.1 of the inventory.

```
1.1.1.2.1. -VFR          -PRE-TAC     -LAUNCH       -COA          T-W
    FACTOR        WT    F-1  F18  VF1  VF2   CUMWT
 1) TAXI/CAT     *( 20) 50   50   50   50     2.22%
 2) PWR-RUNUP    *( 20) 50   70   50   50     2.22%
 3) ROTATION     *( 20) 50   60   50   50     2.22%
 4) CLEAN-UP     *( 20) 50   80   50   50     2.22%
 5) LNCH-PATRN   *( 20) 50   60   50   50     2.22%
    TOTAL               50   64   50   50    11.11%
```

As illustrated, the factor has five sub-factors which are, in this case, tasks. There are four columns of data headed respectively by the labels F-1, F18, VF1, and VF2. Only the F18 column contains actual ratings. The F-1, VF1, and VF2 columns represent potential systems that could be evaluated and compared to the F18. In all cases these A/C were assigned the arbitrary rating of satisfactory (50).

A scale of 0 to 80 was used. These numbers correspond to the ratings actually given on the scale described in Section 2.2 multiplied by a factor of ten (purely for computational reasons.)

Between the task-label column and the task-score columns are weights in parentheses. These weights are normalized versions of those relative importance weights described in Section 2.1. Weights are normalized to sum to 100 within a factor. The model normalizes scores so that the best possible A/C would receive a score of 80, the worst a 0, etc.

The asterisks next to the weights indicate that the associated factor level is a data input level. That is, a rating is necessary for each of the tasks for each of the A/C.

To the far right is a CUMWT column. The cumwt (cumulative weight) of a sub-factor indicates the total percentage that that sub-factor can make to the overall system score. The size of the cumwt is dependent on the aggregation rules chosen, the number of levels in the hierarchy, the relative importance weights at each level, and the particular position of a factor in the hierarchy.

The final row of the table for factor 1.1.1.2.1 contains the aggregated ratings for each A/C for that factor. These are obtained by multiplication of task scores by relative importance weights and summing across tasks within air systems (normalizing appropriately).

As indicated in the display of the factor 1.1.1. in the next highest level in the hierarchy, the total output of factor 1.1.1.1 serves as input at the next highest hierarchy level. These numbers are combined using appropriate importance weights, and values are thus aggregated up through the hierarchy.

1.1.1. -TOTAL SYS -VFR				-PRE-TAC		T-W
FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) PRELAUNCH	(0)	50	50	50	50	.00%
2) LAUNCH	(33)	50	64	50	50	11.11%
3) CLIMB	(33)	50	65	50	50	11.11%
4) RNDEVOUS	(33)	50	65	50	50	11.11%
TOTAL		50	65	50	50	33.33%

As indicated in the following output of the inventory, importance weights that were assigned above the task level are equal for all sub-factors within a factor. This is a tentative result and will be further investigated.

Finally, in order to examine the F18 differentially with respect to the lead and the wingman positions, two models have been created by simply assigning all importance

at the level of the lead/wing/wing dichotomy to first lead and then wing.

The following is the output for the lead followed by that for the wingman.

3/31/77 - F-18 MODEL COA:LEAD

1. -TOTAL SYS T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) VFR	(100)	50	59	50	50	100.00%
TOTAL		50	59	50	50	100.00%

1.1. -TOTAL SYS -VFR T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) PRE-TAC	(33)	50	65	50	50	33.33%
2) TACTICAL	(33)	50	56	50	50	33.33%
3) POST TAC	(33)	50	58	50	50	33.33%
TOTAL		50	59	50	50	100.00%

1.1.1. -TOTAL SYS -VFR -PRE-TAC T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) PRELAUNCH	(0)	50	50	50	50	.00%
2) LAUNCH	(33)	50	64	50	50	11.11%
3) CLIMB	(33)	50	65	50	50	11.11%
4) RNDEVOUS	(33)	50	65	50	50	11.11%
TOTAL		50	65	50	50	33.33%

1.1.1.1. -TOTAL SYS -VFR -PRE-TAC -PRELAUNCH T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) SYS/MGR	*(50)	50	50	50	50	.00%
2) TACTN	*(50)	50	50	50	50	.00%
TOTAL		50	50	50	50	.00%

1.1.1.2. -TOTAL SYS -VFR -PRE-TAC -LAUNCH T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) COA	(100)	50	64	50	50	11.11%
2) SYS/MGR	(0)	50	50	50	50	.00%
TOTAL		50	64	50	50	11.11%

1.1.1.2.1. -VFR -PRE-TAC -LAUNCH -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	TAXI/CAT	*(20)	50	50	50	50	2.22%
2)	PWR-RUNUP	*(20)	50	70	50	50	2.22%
3)	ROTATION	*(20)	50	60	50	50	2.22%
4)	CLEAN-UP	*(20)	50	80	50	50	2.22%
5)	LNCH-PATRN	*(20)	50	60	50	50	2.22%
	TOTAL		50	64	50	50	11.11%

1.1.1.2.2. -VFR -PRE-TAC -LAUNCH -SYS/MGR T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	CHKLIST	*(100)	50	50	50	50	.00%
	TOTAL		50	50	50	50	.00%

1.1.1.3. -TOTAL SYS -VFR -PRE-TAC -CLIMB T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	65	50	50	11.11%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	65	50	50	11.11%

1.1.1.3.1. -VFR -PRE-TAC -CLIMB -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	CLIMB OUT	*(50)	50	70	50	50	5.56%
2)	TRANSITION	*(50)	50	60	50	50	5.56%
	TOTAL		50	65	50	50	11.11%

1.1.1.4. -TOTAL SYS -VFR -PRE-TAC -RNDEVOUS T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	65	50	50	11.11%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
3)	TACTN	*(0)	50	50	50	50	.00%
	TOTAL		50	65	50	50	11.11%

1.1.1.4.1. -VFR -PRE-TAC -RNDEVOUS -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	VIS ACQUIS	*(12)	50	70	50	50	1.36%
2)	CV RNDVS	*(20)	50	60	50	50	2.27%
3)	PARADE POS	*(16)	50	60	50	50	1.81%
4)	CROS UNDRS	*(10)	50	60	50	50	1.13%
5)	CRUISE POS	*(10)	50	60	50	50	1.13%
6)	LEAD CHNGE	*(10)	50	60	50	50	1.13%
7)	CHECKOUT	*(20)	50	80	50	50	2.27%
	TOTAL		50	65	50	50	11.11%

1.1.2. -TOTAL SYS -VFR -TACTICAL T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	INGRESS	(20)	50	51	50	50	6.67%
2)	MRI(AIM 7)	(20)	50	60	50	50	6.67%
3)	SAM(SA-2)	(20)	50	50	50	50	6.67%
4)	ACM(AIM-9)	(20)	50	68	50	50	6.67%
5)	EGRESS	(20)	50	50	50	50	6.67%
	TOTAL		50	56	50	50	33.33%

1.1.2.1. -TOTAL SYS -VFR -TACTICAL -INGRESS T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	51	50	50	6.67%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
3)	TACTN	*(0)	50	50	50	50	.00%
	TOTAL		50	51	50	50	6.67%

1.1.2.1.1. -VFR -TACTICAL -INGRESS -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	ACC TO SPD	*(56)	50	60	50	50	3.70%
2)	VIS SCAN	*(44)	50	40	50	50	2.96%
	TOTAL		50	51	50	50	6.67%

1.1.2.2. -TOTAL SYS -VFR -TACTICAL -MRI(AIM 7) T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	60	50	50	6.67%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
3)	TACTICIAN	*(0)	50	50	50	50	.00%
	TOTAL		50	60	50	50	6.67%

1.1.2.2.1. -VFR -TACTICAL -MRI(AIM 7)-COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	LEAD	(100)	50	60	50	50	6.67%
2)	WINGMAN	(0)	50	41	50	50	.00%
	TOTAL		50	60	50	50	6.67%

1.1.2.2.1.1. -TACTICAL -MRI(AIM 7)-COA -LEAD T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	AQIRE TRGT	*(29)	50	50	50	50	1.96%
2)	WPNS DSPLY	*(26)	50	60	50	50	1.76%
3)	LNCH WPN	*(29)	50	70	50	50	1.96%
4)	RE AQUIRE	*(15)	50	60	50	50	.98%
	TOTAL		50	60	50	50	6.67%

1.1.2.2.1.2. -TACTICAL -MRI(AIM 7)-COA -WINGMAN T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	AQIRE TRGT	*(29)	50	30	50	50	.00%
2)	WPNS DSPLY	*(26)	50	40	50	50	.00%
3)	LNCH WPN	*(29)	50	50	50	50	.00%
4)	RE&AQUIRE	*(15)	50	50	50	50	.00%
	TOTAL		50	41	50	50	.00%

1.1.2.3. -TOTAL SYS -VFR -TACTICAL -SAM(SA-2) T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	50	50	50	6.67%
2)	SYS/MGR	*(	50	50	50	50	.00%
3)	TACTICIAN	*(0)	50	50	50	50	.00%
	TOTAL		50	50	50	50	6.67%

1.1.2.3.1. -VFR -TACTICAL -SAM(SA-2) -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	LEAD	(100)	50	50	50	50	6.67%
2)	WINGMAN	(0)	50	40	50	50	.00%
	TOTAL		50	50	50	50	6.67%

1.1.2.3.1.1. -TACTICAL -SAM(SA-2) -COA -LEAD T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) MNTR DSPLY	*(50)	50	60	50	50	3.33%
2) VIS AQIRE	*(50)	50	40	50	50	3.33%
TOTAL		50	50	50	50	6.67%

1.1.2.3.1.2. -TACTICAL -SAM(SA-2) -COA -WINGMAN T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) MNTR DSPLY	*(50)	50	50	50	50	.00%
2) VIS AQIRE	*(50)	50	30	50	50	.00%
TOTAL		50	40	50	50	.00%

1.1.2.4. -TOTAL SYS -VFR -TACTICAL -ACM(AIM-9) T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) COA	(100)	50	68	50	50	6.67%
2) SYS/MGR	*(0)	50	50	50	50	.00%
3) TACTICIAN	*(0)	50	50	50	50	.00%
TOTAL		50	68	50	50	6.67%

1.1.2.4.1. -VFR -TACTICAL -ACM(AIM-9)-COA T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) LEAD	(100)	50	68	50	50	6.67%
2) WINGMAN	(0)	50	58	50	50	.00%
TOTAL		50	68	50	50	6.67%

1.1.2.4.1.1. -TACTICAL -ACM(AIM-9)-COA -LEAD T-W

FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1) MNVR THRT	*(35)	50	70	50	50	2.32%
2) USE WPNS	*(43)	50	70	50	50	2.90%
3) REAQUIRE	*(22)	50	60	50	50	1.45%
TOTAL		50	68	50	50	6.67%

1.1.2.4.1.2. -TACTICAL -ACM(AIM-9)-COA -WINGMAN T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	MNVR THRT	*(35)	50	60	50	50	.00%
2)	USE WPNS	*(43)	50	60	50	50	.00%
3)	REAQUIRE	*(22)	50	50	50	50	.00%
	TOTAL		50	58	50	50	.00%

1.1.2.5. -TOTAL SYS -VFR -TACTICAL -EGRESS T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	50	50	50	6.67%
	TOTAL		50	50	50	50	6.67%

1.1.2.5.1. -VFR -TACTICAL -EGRESS -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	LEAD	(100)	50	50	50	50	6.67%
2)	WINGMAN	*(0)	50	50	50	50	.00%
	TOTAL		50	50	50	50	6.67%

1.1.2.5.1.1. -TACTICAL -EGRESS -COA -LEAD T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	VIS SCAN	*(100)	50	50	50	50	6.67%
	TOTAL		50	50	50	50	6.67%

1.1.3. -TOTAL SYS -VFR -POST TAC T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	INFLT FUEL	(25)	50	66	50	50	8.33%
2)	MARSHALL	(25)	50	50	50	50	8.33%
3)	PRE-LNDNG	(25)	50	60	50	50	8.33%
4)	LANDING	(25)	50	55	50	50	8.33%
5)	TRN AROUND	(0)	50	50	50	50	.00%
	TOTAL		50	58	50	50	33.33%

1.1.3.1. -TOTAL SYS -VFR -POST TAC -INFLT FUEL T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	66	50	50	8.33%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	66	50	50	8.33%

1.1.3.1.1. -VFR -POST TAC -INFLT FUEL-COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	VIS AQIS	*(22)	50	70	50	50	1.81%
2)	RNDEVOUS	*(35)	50	70	50	50	2.90%
3)	TANKING	*(43)	50	60	50	50	3.62%
	TOTAL		50	66	50	50	8.33%

1.1.3.2. -TOTAL SYS -VFR -POST TAC -MARSHALL T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	50	50	50	8.33%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	50	50	50	8.33%

1.1.3.2.1. -VFR -POST TAC -MARSHALL -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	MAKE TIME	*(33)	50	50	50	50	2.78%
2)	CHK LST	*(67)	50	50	50	50	5.56%
	TOTAL		50	50	50	50	8.33%

1.1.3.3. -TOTAL SYS -VFR -POST TAC -PRE-LNDNG T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	60	50	50	8.33%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	60	50	50	8.33%

1.1.3.3.1. -VFR -POST TAC -PRE-LNDNG -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	PENETRATON	*(33)	50	60	50	50	2.78%
2)	TRANSITION	*(67)	50	60	50	50	5.56%
	TOTAL		50	60	50	50	8.33%

1.1.3.4. -TOTAL SYS -VFR -POST TAC -LANDING T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	55	50	50	8.33%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	55	50	50	8.33%

1.1.3.4.1. -VFR -POST TAC -LANDING -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	GLIDE-SLPE	*(20)	50	40	50	50	1.70%
2)	LINE-UP	*(16)	50	60	50	50	1.36%
3)	MNTN SPED	*(20)	50	60	50	50	1.70%
4)	WAVE-OFF	*(16)	50	60	50	50	1.36%
5)	AREST GEAR	*(10)	50	60	50	50	.85%
6)	FLAP/WINGS	*(8)	50	50	50	50	.68%
7)	SYS CHCK	*(8)	50	60	50	50	.68%
8)	CCA	*(0)	50	50	50	50	.00%
9)	LAND/IFR	*(0)	50	50	50	50	.00%
	TOTAL		50	55	50	50	8.33%

1.1.3.5. -TOTAL SYS -VFR -POST TAC -TRN AROUND T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	SYS/MGR	*(50)	50	50	50	50	.00%
2)	TACTICIAN	*(50)	50	50	50	50	.00%
	TOTAL		50	50	50	50	.00%

1. -TOTAL SYS T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	VFR	(100)	50	57	50	50	100.00%
	TOTAL		50	57	50	50	100.00%

1.1. -TOTAL SYS -VFR T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	PRE-TAC	(33)	50	65	50	50	33.33%
2)	TACTICAL	(33)	50	48	50	50	33.33%
3)	POST TAC	(33)	50	58	50	50	33.33%
	TOTAL		50	57	50	50	100.00%

1.1.1. -TOTAL SYS -VFR -PRE-TAC T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	PRELAUNCH	(0)	50	50	50	50	.00%
2)	LAUNCH	(33)	50	64	50	50	11.11%
3)	CLIMB	(33)	50	65	50	50	11.11%
4)	RNDEVOUS	(33)	50	65	50	50	11.11%
	TOTAL		50	65	50	50	33.33%

1.1.1.1. -TOTAL SYS -VFR -PRE-TAC -PRELAUNCH T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	SYS/MGR	*(50)	50	50	50	50	.00%
2)	TACTN	*(50)	50	50	50	50	.00%
	TOTAL		50	50	50	50	.00%

1.1.1.2. -TOTAL SYS -VFR -PRE-TAC -LAUNCH T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	64	50	50	11.11%
2)	SYS/MGR	(0)	50	50	50	50	.00%
	TOTAL		50	64	50	50	11.11%

1.1.1.2.1. -VFR -PRE-TAC -LAUNCH -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	TAXI/CAT	*(20)	50	50	50	50	2.22%
2)	PWR-RUNUP	*(20)	50	70	50	50	2.22%
3)	ROTATION	*(20)	50	60	50	50	2.22%
4)	CLEAN-UP	*(20)	50	80	50	50	2.22%
5)	LNCH-PATRN	*(20)	50	60	50	50	2.22%
	TOTAL		50	64	50	50	11.11%

1.1.1.2.2. -VFR -PRE-TAC -LAUNCH -SYS/MGR T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	CHKLIST	*(100)	50	50	50	50	.00%
	TOTAL		50	50	50	50	.00%

1.1.1.3. -TOTAL SYS -VFR -PRE-TAC -CLIMB T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	65	50	50	11.11%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	65	50	50	11.11%

1.1.1.3.1. -VFR -PRE-TAC -CLIMB -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	CLIMB OUT	*(50)	50	70	50	50	5.56%
2)	TRANSITION	*(50)	50	60	50	50	5.56%
	TOTAL		50	65	50	50	11.11%

1.1.1.4. -TOTAL SYS -VFR -PRE-TAC -RNDEVOUS T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	65	50	50	11.11%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
3)	TACTN	*(0)	50	50	50	50	.00%
	TOTAL		50	65	50	50	11.11%

1.1.1.4.1. -VFR -PRE-TAC -RNDEVOUS -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	VIS ACQUIS	*(12)	50	70	50	50	1.36%
2)	CV RNDVS	*(20)	50	60	50	50	2.27%
3)	PARADE POS	*(16)	50	60	50	50	1.81%
4)	CROS UNDRS	*(10)	50	60	50	50	1.13%
5)	CRUISE POS	*(10)	50	60	50	50	1.13%
6)	LEAD CHNGE	*(10)	50	60	50	50	1.13%
7)	CHECKOUT	*(20)	50	80	50	50	2.27%
	TOTAL		50	65	50	50	11.11%

1.1.2. -TOTAL SYS -VFR -TACTICAL T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	INGRESS	(20)	50	51	50	50	6.67%
2)	MRI(AIM 7)	(20)	50	41	50	50	6.67%
3)	SAM(SA-2)	(20)	50	40	50	50	6.67%
4)	ACM(AIM-9)	(20)	50	58	50	50	6.67%
5)	EGRESS	(20)	50	50	50	50	6.67%
	TOTAL		50	48	50	50	33.33%

1.1.2.1. -TOTAL SYS -VFR -TACTICAL -INGRESS T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	51	50	50	6.67%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
3)	TACTN	*(0)	50	50	50	50	.00%
	TOTAL		50	51	50	50	6.67%

1.1.2.1.1. -VFR -TACTICAL -INGRESS -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	ACC TO SPD	*(56)	50	60	50	50	3.70%
2)	VIS SCAN	*(44)	50	40	50	50	2.96%
	TOTAL		50	51	50	50	6.67%

1.1.2.2. -TOTAL SYS -VFR -TACTICAL -MRI(AIM 7) T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	41	50	50	6.67%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
3)	TACTICIAN	*(0)	50	50	50	50	.00%
	TOTAL		50	41	50	50	6.67%

1.1.2.2.1. -VFR -TACTICAL -MRI(AIM 7)-COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	LEAD	(100)	50	60	50	50	6.67%
2)	WINGMAN	(0)	50	41	50	50	.00%
	TOTAL		50	60	50	50	6.67%

1.1.2.2.1.1. -TACTICAL -MRI(AIM 7)-COA -LEAD T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	AQIRE TRGT	*(29)	50	50	50	50	1.96%
2)	WPNS DSPLY	*(26)	50	60	50	50	1.76%
3)	LNCH WPN	*(29)	50	70	50	50	1.96%
4)	RE AQUIRE	*(15)	50	60	50	50	.98%
	TOTAL		50	60	50	50	6.67%

1.1.2.2.1.2. -TACTICAL -MRI(AIM 7)-COA -WINGMAN T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	AQIRE TRGT	*(29)	50	30	50	50	.00%
2)	WPNS DSPLY	*(26)	50	40	50	50	.00%
3)	LNCH WPN	*(29)	50	50	50	50	.00%
4)	RE&AQUIRE	*(15)	50	50	50	50	.00%
	TOTAL		50	41	50	50	.00%

1.1.2.3. -TOTAL SYS -VFR -TACTICAL -SAM(SA-2) T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	50	50	50	6.67%
2)	SYS/MGR	*([illegible]	50	50	50	50	.00%
3)	TACTICIAN	*(0)	50	50	50	50	.00%
	TOTAL		50	50	50	50	6.67%

1.1.2.3.1. -VFR -TACTICAL -SAM(SA-2) -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	LEAD	(100)	50	50	50	50	6.67%
2)	WINGMAN	(0)	50	40	50	50	.00%
	TOTAL		50	50	50	50	6.67%

```
1.1.2.3.1.1. -TACTICAL  -SAM(SA-2) -COA        -LEAD          T-W
    FACTOR        WT    F-1 F18 VF1 VF2  CUMWT
 1) MNTR DSPLY *( 50) 50   60  50  50      .00%
 2) VIS AQIRE  *( 50) 50   40  50  50      .00%
    TOTAL              50   50  50  50      .00%
```

```
1.1.2.3.1.2. -TACTICAL  -SAM(SA-2) -COA        -WINGMAN      T-W
    FACTOR        WT    F-1 F18 VF1 VF2  CUMWT
 1) MNTR DSPLY *( 50) 50   50  50  50     3.33%
 2) VIS AQIRE  *( 50) 50   30  50  50     3.33%
    TOTAL              50   40  50  50     6.67%
```

```
1.1.2.4. -TOTAL SYS -VFR         -TACTICAL  -ACM(AIM-9) T-W
    FACTOR        WT    F-1 F18 VF1 VF2  CUMWT
 1) COA          (100) 50   58  50  50     6.67%
 2) SYS/MGR    *(   0) 50   50  50  50      .00%
 3) TACTICIAN  *(   0) 50   50  50  50      .00%
    TOTAL              50   58  50  50     6.67%
```

```
1.1.2.4.1. -VFR         -TACTICAL  -ACM(AIM-9)-COA          T-W
    FACTOR        WT    F-1 F18 VF1 VF2  CUMWT
 1) LEAD         (   0) 50   68  50  50      .00%
 2) WINGMAN      (100) 50   58  50  50     6.67%
    TOTAL              50   58  50  50     6.67%
```

```
1.1.2.4.1.1. -TACTICAL  -ACM(AIM-9)-COA        -LEAD          T-W
    FACTOR        WT    F-1 F18 VF1 VF2  CUMWT
 1) MNVR THRT  *( 35) 50   70  50  50      .00%
 2) USE WPNS   *( 43) 50   70  50  50      .00%
 3) REAQUIRE   *( 22) 50   60  50  50      .00%
    TOTAL              50   68  50  50      .00%
```

1.1.2.4.1.2. -TACTICAL -ACM(AIM-9)-COA -WINGMAN T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	MNVR THRT	*(35)	50	60	50	50	2.32%
2)	USE WPNS	*(43)	50	60	50	50	2.90%
3)	REAQUIRE	*(22)	50	50	50	50	1.45%
	TOTAL		50	58	50	50	6.67%

1.1.2.5. -TOTAL SYS -VFR -TACTICAL -EGRESS T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	50	50	50	6.67%
	TOTAL		50	50	50	50	6.67%

1.1.2.5.1. -VFR -TACTICAL -EGRESS -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	LEAD	(100)	50	50	50	50	6.67%
2)	WINGMAN	*(0)	50	50	50	50	.00%
	TOTAL		50	50	50	50	6.67%

1.1.2.5.1.1. -TACTICAL -EGRESS -COA -LEAD T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	VIS SCAN	*(100)	50	50	50	50	6.67%
	TOTAL		50	50	50	50	6.67%

1.1.3. -TOTAL SYS -VFR -POST TAC T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	INFLT FUEL	(25)	50	66	50	50	8.33%
2)	MARSHALL	(25)	50	50	50	50	8.33%
3)	PRE-LNDING	(25)	50	60	50	50	8.33%
4)	LANDING	(25)	50	55	50	50	8.33%
5)	TRN AROUND	(0)	50	50	50	50	.00%
	TOTAL		50	58	50	50	33.33%

1.1.3.1. -TOTAL SYS -VFR -POST TAC -INFLT FUEL T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	66	50	50	8.33%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	66	50	50	8.33%

1.1.3.1.1. -VFR -POST TAC -INFLT FUEL-COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	VIS AQIS	*(22)	50	70	50	50	1.81%
2)	RNDEVOUS	*(35)	50	70	50	50	2.90%
3)	TANKING	*(43)	50	60	50	50	3.62%
	TOTAL		50	66	50	50	8.33%

1.1.3.2. -TOTAL SYS -VFR -POST TAC -MARSHALL T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	50	50	50	8.33%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	50	50	50	8.33%

1.1.3.2.1. -VFR -POST TAC -MARSHALL -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	MAKE TIME	*(33)	50	50	50	50	2.78%
2)	CHK LST	*(67)	50	50	50	50	5.56%
	TOTAL		50	50	50	50	8.33%

1.1.3.3. -TOTAL SYS -VFR -POST TAC -PRE-LNDNG T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	60	50	50	8.33%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	60	50	50	8.33%

1.1.3.3.1. -VFR -POST TAC -PRE-LNDNG -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	PENETRATON	*(33)	50	60	50	50	2.78%
2)	TRANSITION	*(67)	50	60	50	50	5.56%
	TOTAL		50	60	50	50	8.33%

1.1.3.4. -TOTAL SYS -VFR -POST TAC -LANDING T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	COA	(100)	50	55	50	50	8.33%
2)	SYS/MGR	*(0)	50	50	50	50	.00%
	TOTAL		50	55	50	50	8.33%

1.1.3.4.1. -VFR -POST TAC -LANDING -COA T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	GLIDE-SLPE	*(20)	50	40	50	50	1.70%
2)	LINE-UP	*(16)	50	60	50	50	1.36%
3)	MNTN SPED	*(20)	50	60	50	50	1.70%
4)	WAVE-OFF	*(16)	50	60	50	50	1.36%
5)	AREST GEAR	*(10)	50	60	50	50	.85%
6)	FLAP/WINGS	*(8)	50	50	50	50	.68%
7)	SYS CHCK	*(8)	50	60	50	50	.68%
8)	CCA	*(0)	50	50	50	50	.00%
9)	LAND/IFR	*(0)	50	50	50	50	.00%
	TOTAL		50	55	50	50	8.33%

1.1.3.5. -TOTAL SYS -VFR -POST TAC -TRN AROUND T-W

	FACTOR	WT	F-1	F18	VF1	VF2	CUMWT
1)	SYS/MGR	*(50)	50	50	50	50	.00%
2)	TACTICIAN	*(50)	50	50	50	50	.00%
	TOTAL		50	50	50	50	.00%

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